RESEARCH CIRCULAR 244 NOVEMBER 1978

Western Ohio Grain Flows and Transportation Modes, 1975-76

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CONTENTS

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ACKNOWLEDGMENTS

The authors express appreciation to Professors E. Dean Baldwin, David E. Hahn, and John W. Sharp, Dept. of Agricultural Economics and Rural Sociology, The Ohio State University and Ohio Agricultural Research and Development Center, for helpful comments on this document. The authors are grateful for the assistance of Linda Buttel, Karlene Robison, and the personnel of the Data Processing and Graphic Arts Center in programming, typing, and tabulating data for this study. Special thanks are extended to the elevator operators of western Ohio who took the time required to complete the questionnaire which provided the summary data reported in this manuscript. Any errors remain the sole responsibility of the authors.

AGDEX 110/843 11-78-2.5M

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DONALD W. LARSON and MICHAEL D. KANE[1]

INTRODUCTION

Many changes in Ohio grain market structure, grain transportation system, and grain flows have occurred since the early 1960's. Grain production in 1976 was nearly four times that of 1960. Grain elevators have become fewer in number, larger in size, and more specialized in their operation. The large volume of grain moving to export has greatly increased the importance of export markets in Toledo and on the East Coast. Barge shipments from Cincinnati to the Gulf Coast export elevators have become an important grain transport mode. The Ohio railroad system has been completely reorganized by Congressional legislation. Truck transportation has become increasingly important in Ohio grain transportation.

The above changes have significantly altered the shipping patterns of origin and destination for Ohio grain. Current grain flow information is useful to private and public decision makers interested in grain handling, storage, and transportation. It can assist them in estimating grain handling, storage and transportation needs. No recent published information is available to describe Ohio grain flow by origin, destination, and transport mode.

OBJECTIVES

The main objectives of this study are:

- To describe the major changes which have occurred in the Ohio grain marketing and transportation system.
- To document and measure western Ohio's grain distribution pattern.
- To determine modes of transportation employed in alternative grain flow patterns.
- To measure grain flows among grain handlers and processors.

The first section of this research reviews the major changes in the Ohio grain production and marketing system. Section two discusses the methodology used in the current study. The third section presents the results on grain flows and transport modes for western Ohio. The conclusions of the study are presented in the final section.

GRAIN PRODUCTION AND MARKETING

Production of corn, soybeans, wheat, and oats was 594 million bushels in 1976—an increase nearly four times the production of 1960. Increases in crop yields and acreage harvested have contributed to this increased production. Additional increases in grain production are projected for 1984, 1989, and 1999 (3). Such production increases, and therefore grain flow increases, will require a modern grain marketing distribution system to handle this large volume of grain.

Market Structure

The number, size, and location of Ohio grain elevators have changed dramatically. The number of elevators has decreased from about 1,224 in 1954 to 926 in 1975 (Table 1). This represents nearly a 26% decrease for the state. The decrease in elevator numbers has been concentrated in the small firms with less than 100,000 bushels of storage capacity. The closing of these firms explains the decrease in elevator numbers for the entire state. All but one Crop Reporting District (CRD) shows a decline in elevator numbers from 1954 to 1975. The decrease is greatest in CRD's 3, 5, 6, 8, and 9. This is the area of Ohio where grain production is relatively less important. In the main grain producing area of the state, western Ohio, the number of elevators has decreased less rapidly. The CRD's in western Ohio also have the largest absolute number of elevators.

Total storage capacity of the elevator sector has increased rapidly—650% in the 1954 to 1975 period. Total storage capacity was about 200 million bushels in 1975. The average size of elevator has increased from more than 21,000 bushels in 1954 to about 215,000 bushels of storage capacity in 1975.

The size distribution of elevators has also changed. Ohio had only 10 elevators with more than 900,000 bushel storage capacity in 1954, whereas in 1975 the state had 36 elevators that size. The fastest growth in elevator numbers has occurred in the 300,000 to 500,000 bushel storage capacity in this same period. More large elevators, sub-terminals, are now located directly in production areas than was the case in the 1950's and 1960's.

Grain Unit Trains

The grain rent-a-train rate, first published by the Norfolk and Western Railroad for unit train shipments from Illinois to the East Coast in April 1969, initiated a new era in grain transportation. These rates result in considerably reduced transportation

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charges for elevators which have the facilities to use unit trains of 60 to 100 cars.

The first unit train shipment of grain from Ohio was made in the early 1970's. Since that time the use of unit train grain shipments has increased rapidly in Ohio. Unit train facilities had been constructed at 27 locations in Ohio in 1976 (Table 2). Since each location ships several trainloads per year and each 100-car trainload carries about 330,000 bushels of grain, the destination and flow of grain has been significantly altered by this change in rail rates. These rates have had major impact on grain flows to export markets.

Ohio currently has unit train rates only for shipments to the East Coast export markets. No unit train rates are available for domestic market destinations at the present time except to one corn processor in Pennsylvania. The introduction of unit train rates for domestic destinations would likely cause further increases in the use of these trains, the number of elevators with the capacity to load them, and receiving facilities with the capability to unload them.

The unit train has important market structure implications because only specialized elevators have the capacity to use them. The local assembly area for each unit train facility is usually much larger than the average elevator has presently. Thus, an increase in these facilities may further the exit of small elevators from the grain trade.

Railroad Reorganization

Ohio railroads have been reorganized under the Regional Rail Reorganization Act of 1973 (RRRA) and the Rail Revitalization and Regulatory Reform Act of 1976 (RRRRA). Under these acts the railroad system of the 17-state Northeast-Midwest region which includes Ohio has been completely restruc-

TABLE 1.—Number of Grain Elevators and Feed Mills, Total Storage Capacity, and Storage Capacity per Plant by Crop Reporting Districts and the State of Ohio, 1954, 1964, and 1975.

Item	Year			Percent Change
	1954	1964	1975	1954 to 1975
Crop Reporting District 1				
Number of elevators	181	174	171	—6
Total storage capacity (000's bu)	5,131	16,877	81,588	1,490.1
CRD 2				
Number of elevators	142	127	165	+16.2
Total storage capacity (000's bu)	4,261	12,052	30,066	605.6
CRD 3				
Number of elevators	177	136	114	—35.6
Total storage capacity (000's bu)	1,292	1,632	4,192	224.5
CRD 4				
Number of elevators	174	154	137	—21.3
Total storage capacity (000's bu)	6,649	15,835	28,692	331.5
CRD 5				
Number of elevators	180	153	120	—33.4
Total storage capacity (000's bu)	6,627	11,828	31,408	373.9
CRD 6				
Number of elevators	84	66	42	—50.0
Total storage capacity (000's bu)	284	254	1,397	391.9
CRD 7				
Number of elevators	130	102	93	—29.5
Total storage capacity (000's bu)	1,830	4,068	18,991	937.7
CRD 8				
Number of elevators	81	75	46	—43.2
Total storage capacity (000's bu)	326	930	1,997	512.6
CRD 9				
Number of elevators	75	62	38	—49.3
Total storage capacity (000's bu)	179	265	1,027	473.7
State of Ohio				
Number of elevators and feed mills	1,224	1,049	926	—25.5
Total storage capacity (000's bu)	26,579	63,741	199,358	650.1
Storage Capacity per Elevator	21,714	60,763	215,289	891.5

Sources: Westerhold (7) and Ohio Dept. of Agriculture, Grain Warehouse Division, 1975.

FIG. 1.—Rail Line Network in Ohio Prior to Reorganization.

tured. The Consolidated Rail Corporation (Conrail), a government owned-for-profit corporation, assumed control over the bankrupt Penn Central, Erie Lackawanna, and other railroad companies on April 1, 1976.

As required by the provisions of RRRRA, Title IV, the Federal Railroad Administration (FRA) approves, modifies, and annually reviews state rail plans. The rail plan for the state of Ohio was approved on April 1, 1976, after submission of required modifications to FRA.

The state of Ohio rail network which existed prior to reorganization consisted of about 7,500 miles of rail lines which are served by three main carriers, Conrail, Chesapeake and Ohio, and the Norfolk and Western. An important element of the rail reorganization plan has been the abandonment of uneconomical lines. Ohio has a total of 73 branch lines and 873 miles of track which rail carriers have identified as potentially uneconomic in the state. These 873 miles represent about 12% of the total rail mileage in Ohio. Since many of these rail lines are located in western Ohio, this reorganization is important to the grain transportation industry of Ohio.

These changes in grain market structure, grain production, and railroad transportation have important implications for the origin, destination, flow of grain, and use of alternative transport modes. The remainder of this paper describes the 1975-76 grain movements for western Ohio.

TABLE 2.—Location, Name of Firm, and Storage Capacity of Unit Train Facilities in Ohio, 1976.

Location	Name of Firm	Capacity (000 bu)
Toledo	The Andersons	18,950
	Mid State Terminals	4,700
	Cargill	4,600
Fostoria	The Ohio Farmers Grain	5,423
Huron	Pillsbury Company	1,700
Harpster	Pillsbury Company	387
Lilly Chapel	Pillsbury Company	800
Bellevue	Central Soya	5,630
Marion	Central Soya	5,100
Mansfield	Early and Daniel	1,400
Troy	Early and Daniel	1,909
Lima	Cargill	2,150
Mechanicsburg	The Ohio Grain Company	2,014
Coshocton	The Coshocton Grain Co.	783
Alger	Alger Feed and Grain Co.	800
Kenton	Landmark	1,050
South Charleston	Landmark	1,300
Sidney	Landmark	1,430
Arcanum	Continental Grain Co.	775
Columbus	Landmark	5,600
	Continental Grain Co.	2,900
	International Multi Foods	1,250
Cincinnati	Central Soya	4,136
	Queen City Grain	1,229
	Early and Daniel	3,023
Jeffersonville*	Landmark	1,157
Montpelier*	Landmark	750

*Began operation in 1977 harvest season.
Source: Sharp (6).

METHODOLOGY

Three primary characteristics make Crop Reporting Districts (CRD's) 4, 5, and 7 plus Allen and Van Wert counties an appropriate region for a study of grain flows.[2] First, this area annually accounts for more than 50% of Ohio's corn and soybean production and more than 45% of the wheat. Second, all major modes of grain transportation are available in the study area. And third, about 41% of Ohio's 926 grain elevators are distributed throughout the region. The study area is outlined in Figure 2.

A stratified sample based on elevator size was drawn to obtain a representative sample for the study area. Questionnaires for 57 elevators were completed between June and October, 1976. Information was collected on elevator size, utilization of transport modes, grain receipts, grain flows for the 1975-76 crop year, and rail abandonment. The elevator population and number of respondents are shown in Table 3.

WESTERN OHIO GRAIN FLOWS AND STORAGE

Grain is an important commodity in CRD's 4, 5, and 7. Producers in the area harvested 34.4 million bushels of wheat, 56.8 million bushels of soybeans, and 178.0 million bushels of corn in 1975

[2]Allen and Van Wert counties were the only counties from CRD 1 included in the study. They were included because some of the potentially uneconomic rail branch lines located in CRD 4 extend into these counties.

TABLE 3.—Elevator Population and Number of Usable Questionnaires by Elevator Size Category, Western Ohio, 1976.

Item	Elevator Storage Capacity Thousands of Bushels 1-99	100-299	300-499	500 or More	Total
Population*	222	85	23	47	377
Sample	8	15	12	22	57

*The grain elevator population was obtained from: 1) the Ohio Dept. of Agriculture Grain Warehouse Section's 1976 list of firms and 2) the 1976 Annual Directory of the Ohio Grain, Feed and Fertilizer Association.

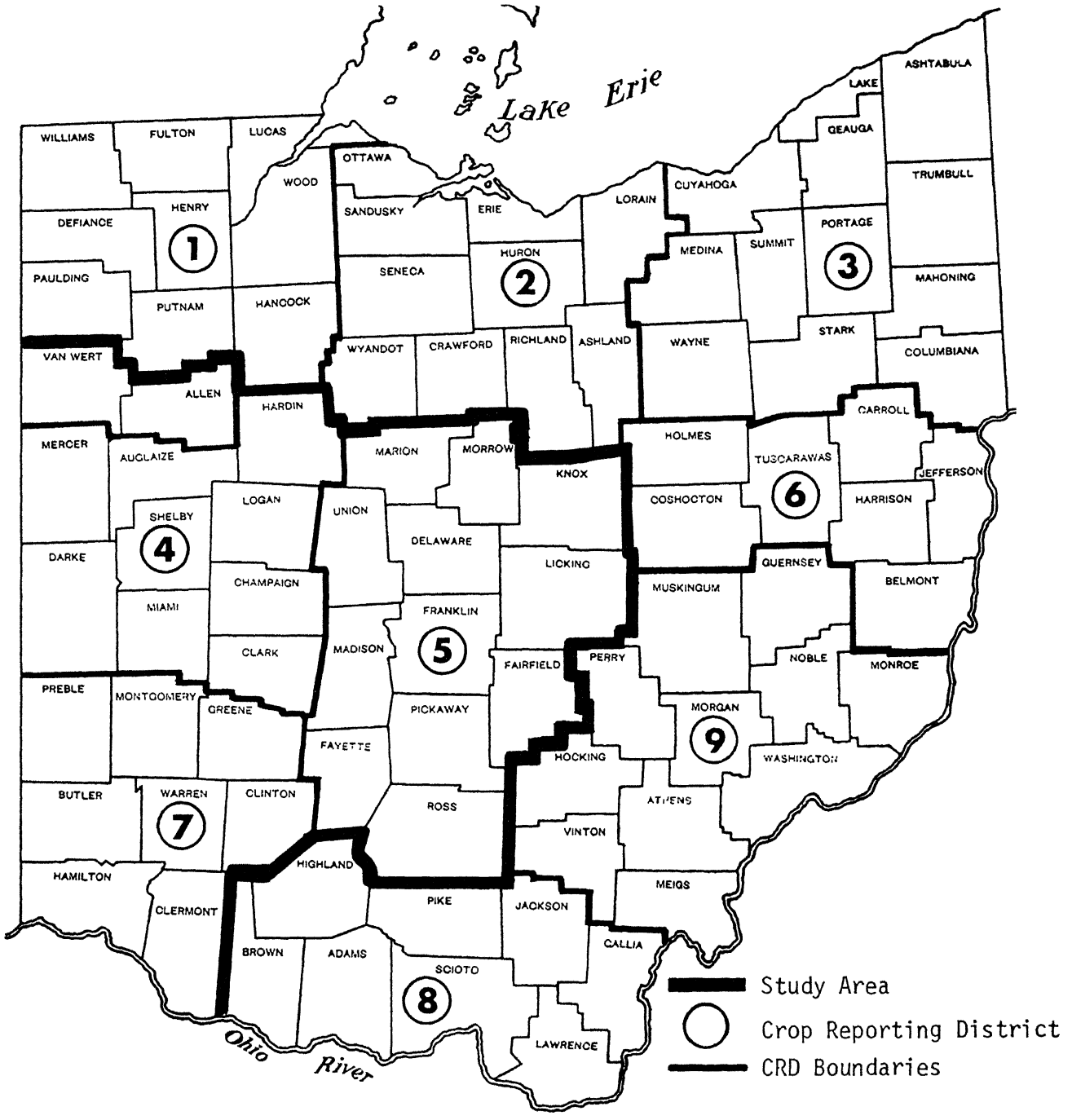

FIG. 2.—Western Ohio Grain Flow Study Area, 1975-76.

(Table 4). Corn production was adjusted downward by the amount of corn estimated for livestock feed (more than 48 million bushels) to obtain the 130.1 million bushels of estimated marketable surplus of corn (Table 4). To determine the amount of corn fed to livestock, estimates of livestock numbers by class of livestock and county were made. The number of bushels of corn fed to each livestock class multiplied by the number of livestock in each class provided an estimate of total corn fed to livestock by county.[3] None of the wheat harvested was assumed fed to livestock because the wheat-to-corn price ratio in 1975 was such that wheat was not fed. The total marketable surplus of grain was estimated to be 221.3 million bushels in 1975.

More than 85% of the 34.4 million bushel wheat crop moved off the farm into the marketing system from June 1 to August 31, 1975.[4] The remaining 15% was stored on farms. By January 1976, only 9% of the wheat harvest remained in on-farm storage but 42.6% of the harvest was still in off-farm storage. This translates into 4.8 million bushels of wheat on farms and 17.4 million bushels off farms.

[3]See Kane (2) for additional information on this procedure.

[4]The amount of grain stored in on-farm and off-farm positions was estimated for the study region from Ohio Agricultural Statistics for 1975 and 1976 (4).

TABLE 4.—Ohio Grain Production for Crop Reporting Districts 4, 5, and 7 and Estimated Marketable Surplus of Corn, 1975-76.

CRD and County	Wheat Production	Soybean Production	Corn Production	Estimated Marketable Surplus of Corn
	(000 bu)			
District 1				
Allen	1717	2050	5272	4205
Van Wert	2105	3443	7477	6977
District 4				
Auglaize	1607	2187	6605	5152
Champaign	1214	1676	8834	6755
Clark	1041	1774	6943	3790
Darke	2115	3771	12041	8746
Hardin	2283	3224	6930	5343
Logan	1008	1742	6110	4780
Mercer	1891	2821	7904	4749
Miami	1556	2198	6730	5152
Shelby	1598	2175	6057	3926
District 5				
Delaware	909	1781	3990	3208
Fairfield	756	1032	5375	3981
Fayette	1254	2419	6725	4687
Franklin	760	1825	3964	3476
Knox	622	512	4026	2667
Licking	773	1263	4618	3241
Madison	1178	2679	8990	6866
Marion	1408	2492	5724	4699
Morrow	561	1110	2832	2282
Pickaway	1406	2534	7972	5773
Ross	863	1261	4648	3323
Union	1466	2415	5490	3922
District 7				
Butler	486	717	3969	2531
Clermont	121	826	900	643
Clinton	889	1744	7478	4984
Greene	629	1068	6156	3827
Hamilton	55	71	502	382
Montgomery	864	1430	3425	2710
Preble	967	1533	7098	4867
Warren	324	1043	3226	2419
Total	34426	56816	178011	130063

Source: Ohio Agricultural Statistics, 1975.

Farmers harvested nearly 57 million bushels of soybeans and more than 130 million bushels of marketable surplus corn in the fall of 1975 (Table 4). About 30% of the soybeans and half of the corn moved to market in the harvest period of Sept. 1 through Dec. 31, 1975. By January 1976, 70% of the soybeans and half of the corn were stored in on-farm or off-farm positions. Some 32% of the soybeans were stored on farms and 38% off farms. Most of the corn (34%) was stored on farms, while only 16% was stored off farms at that time.

An estimated 7.1 million bushels of wheat (21% of the wheat harvest), 21.6 million bushels of soybeans (37% of the soybean harvest), and 29.0 million bushels of corn (22% of the corn harvest) were stored in the study area in June of 1976. About 19% of the wheat harvested was in off-farm storage and the balance was on farms. Some 16% of the soybean harvest was on farms and 21% in off-farm facilities. Most of the corn (15%) was stored on farms and 7% was stored off farms.

Grain Destinations and Transport Modes

Grain shippers in the study area indicated more than 50 in-state, domestic, and export destinations for Ohio grain. Some destinations were primarily transshipment points for domestic and export markets (Lima, Columbus, Cincinnati, and Toledo), while others included major intrastate processors (Bellevue, Dayton, Delphos, Fostoria, Marion, Sidney, and Troy) and many local feed mills. Other major processors of grain from the study area are Decatur, Ind., and Hillsdale, Mich.

All other interstate destinations were all located in the Eastern and Southern regions of the United States. They were grouped into four areas for analysis. Maine, Vermont, New Hampshire, Massachusetts, Rhode Island, and Connecticut were designated as Area A. Area B was composed of New York and Pennsylvania. Virginia was designated Area C and Georgia, South Carolina, and North Carolina comprised Area D.

Grain shipments to these interstate destinations have changed. Grain shipments to Area A (the Northeastern states) have declined relatively and absolutely from 1970 to 1975-76 (1). Area A was not a strong market for Ohio grain in 1975-76.

Area C (Virginia) and Area D (the Carolinas and Georgia) continue to receive a substantial amount of grain from Ohio. These destinations, however, were relatively less important for Ohio grain in 1975-76 than in 1970 (1).

Ohio elevators sent grain to major export markets in Baltimore, Philadelphia, Norfolk-Hampton Roads, Portsmouth, New Orleans, and Baton Rouge via Cincinnati and Toledo. The increased importance of export markets is another major change from 1970 to 1975-76. According to the Baldwin and Sharp study, about 14% of Ohio grain was shipped to export markets in 1970. Grain shipments to export markets from the study area were about 40% of total supply in 1975-76. This is similar to national export levels which show about three-fifths of the wheat, one-half of the soybeans, and one-fourth of the corn crops exported.

More than 52% of the study area's grain production moved out of state to domestic destinations and the export points. More than 93% of these needs were met by rail services. Hence, rail services were extremely important for the interstate grain shipments. This result is the same as that found by Baldwin and Sharp for 1970 grain shipments.

Intrastate grain shipments, by contrast, move almost totally by truck. Rail services are not an important mode of transport for those shipments not utilizing intransit privileges. The short distances for most intrastate destinations make trucking more competitive than rail because of its lower cost for short distances and greater service flexibility. Again, this represents no change from the 1970 results of Baldwin and Sharp.

The increased importance of barge shipments on the Ohio River marks a major change since 1970. Barge shipments of grain on the Ohio River were about 39 million bushels in 1975 and reached 60 million bushels in 1976.[5] Barge shipments of grain on the Ohio were insignificant in 1970.

Ohio elevators transport grain by three principal methods: truck, rail hopper cars, and barge for those elevators located on the Ohio River. Semi-trailers are the usual form of truck transport, although a few elevators use 300 to 500-bushel farm trucks. Elevators may use rail in 1, 3, 5, 10, 60, or 100-car train units, depending on the availability and size of rail siding. The 1 and 3-car units may be either domes-

[5]Information contained in a memorandum from Prof. John W. Sharp to Dean Roy M. Kottman dated Oct. 20, 1977.

TABLE 5.—Relative Importance of Elevator Interstate and Intrastate Grain Shipments by Mode of Transportation for Western Ohio, 1975-76.

Grain	Percent Shipped by Truck	Rail
Corn	31	69
Soybeans	64	36
Wheat	26	74
All Grain	36	64

Source: Ohio Grain Market Survey, 1976.

tic or foreign. The other units are strictly for export with the exception of one 60-car unit location in the East. Four elevators located in Cincinnati utilize barge transport.

About 64% of all grain was shipped by rail in 1975-76 (Table 5). Rail service in this region is most important for wheat and least important for soybeans. This result is due in part to the use of rail transit privileges for wheat shipments and the location of major soybean processors in the study area. The increased use of unit train shipments from elevators assures that rail shipments will continue to be important in the future, but fewer elevators will use rail services. Although data on barge shipments were not reported by the surveyed firms, barge traffic on the Ohio River has increased as grain elevators build facilities on the river.

Grain Flows—Allen and Van Wert Counties

About 75% of the grain shipments originating from Allen and Van Wert counties moved by truck and 25% by rail (Table 6). Some 41% of the shipments occurred in the summer period, while only 20% occurred in the fall. Nearly 39% of the marketed grain was shipped in the off-harvest period.

Major intrastate destinations are Delphos, Toledo, Lima, and Fostoria (Table 6). Decatur, Ind., also received more than 15% of the area's marketable grains (Table 6). Flow to Toledo decreased significantly in the spring but increased to Lima and Decatur during the same period. This occurs because Toledo has a strong demand for grain during the harvest period when the St. Lawrence Seaway is open for export shipments and because of the large storage capacity which exists in that area. When the Seaway freezes and the storage capacity is filled, the Toledo demand and bid price for grain declines relative to other markets. The other markets such as Decatur have a more stable demand throughout the year.[6]

The other domestic interstate destinations were located in the Northeastern U. S. (Area A) and the Virginia region (Area C). These two areas received more than 8% of the grain (Table 6). No grain moved to the Carolinas and Georgia (Area D). These

[6]For more information, see Sappington, Hill, and Baldwin (5).

TABLE 6.—Seasonal Percentages of Total Grain Flows by Truck and Rail from Allen and Van Wert Counties, Crop Year 1975-76.

Destination	Summer 1975		Autumn 1975		Spring 1976		Total
	Truck	Rail	Truck	Rail	Truck	Rail	
	percent						
Ohio Region							
Bellevue			0.90	0.19			1.09
Cincinnati	1.04					0.11	1.15
Cleveland		1.28				0.01	1.29
Columbus		0.39	0.01	0.01		0.23	0.64
Dayton	0.10		0.44		3.49	0.18	4.12
Decatur, Ind.	5.67		1.33		8.30		15.30
Delphos	6.12		1.50		8.46		16.08
Fostoria	3.00		1.11		1.26		5.37
Hillsdale, Mich.		0.17				0.01	0.18
Lima	2.93		2.96		4.07		9.96
Loudonville		1.80				0.17	1.97
Marion	0.18		0.21		0.24		0.63
Sidney	1.79		0.30		0.14		2.23
Toledo	7.00	1.17	7.46		2.28	0.40	18.31
Other U. S. Markets*							
Area A		2.54		0.75		1.95	5.24
Area B		0.71		0.48		0.62	1.81
Area C	0.55	0.76	0.92		1.10		3.33
Area D							
Export Markets							
Baltimore		0.57		1.25		1.25	3.07
Norfolk		0.40				1.00	1.40
Other		2.96		0.36	0.61	2.90	6.83
Total	28.38	12.75	17.14	3.04	29.86	8.83	100.00

*Area A includes Maine, Vermont, New Hampshire, Massachusetts, Rhode Island, and Connecticut; Area B includes New York and Pennsylvania; Area C includes Virginia; and Area D includes Georgia, South Carolina, and North Carolina.

Source: Ohio Grain Market Survey, 1976.

latter markets are not too important for grain from this area because of the greater distances and costs to these markets as opposed to Toledo. Another reason is the relatively poor rail service between these areas. The problem is a lack of through rates between Ohio rail carriers and the Southern railroads.

Only 4.5% of the marketable grain moved to export on the East Coast. About 1.25% of these shipments occurred in the fall and 2.25% moved in the off-season (Table 6).

Grain Flows—Crop Reporting District 4

CRD 4 shows that slightly more than 58% of the shipments moved by truck. This means that 42% moved by rail (Table 7).

About 31% of the grain shipments occurred in the summer, 35% in the fall, and 34% in the off-harvest period. Truck and rail shipments were about equal in the summer and off-harvest periods, but trucks accounted for the majority of shipments in the fall (Table 7).

Major intrastate destinations included Toledo (more than 13%), Fostoria (9%), Dayton (9%), Troy (8.5%), followed by Delphos, Lima, and Cincinnati (Table 7). Toledo received most of its grain in the summer and fall periods. This is the period of strong export demand and the time when elevators want to fill their existing storage capacity. The freezing of the lakes reduces the grain flows despite

TABLE 7.—Seasonal Percentages of Total Grain Flows by Truck and Rail from Crop Reporting District 4, Crop Year 1975-76.

Destination	Summer 1975		Autumn 1975		Spring 1976		Total
	Truck	Rail	Truck	Rail	Truck	Rail	
	percent						
Ohio Region							
Bellevue	0.17		0.48		0.07		0.72
Botkins	0.02				0.05		0.07
Cincinnati	1.17		0.87	0.19	0.82		3.05
Cleveland		0.07		0.02			0.09
Columbus	0.01	0.75	0.39	0.05	0.06	0.33	1.59
Dayton	2.94	0.35	2.11	0.08	3.90		9.38
Decatur, Ind.	1.03		0.02		1.82		2.87
Delphos	2.03		2.41		2.50		6.94
Ft. Recovery	0.16		0.08		0.04		0.28
Ft. Wayne, Ind.			0.04				0.04
Fostoria	1.79	1.57	3.43	0.66	1.97	0.07	9.49
Grafton		0.17					0.17
Hillsdale, Mich.		0.09		0.04		0.90	1.03
Lima	1.37		4.52		0.13		6.02
Lock Two	0.04		0.03		0.09		0.16
Loudonville		0.38					0.38
Marion	0.37		1.16	0.04	0.27		1.84
Piqua			0.05		0.06		0.11
Red Key					0.85		0.85
Rockford	0.24		0.39				0.63
Sidney	0.31		0.40	0.06	0.50		1.27
Toledo	3.04	4.22	5.12	0.37	0.39	0.65	13.79
Troy	2.05	0.05	3.48	0.02	2.95		8.55
Export Markets							
Baltimore		1.29		2.49		3.55	7.33
Norfolk		2.32		2.79		3.47	8.58
Philadelphia		0.02		0.34		1.99	2.35
Other U. S. Markets*							
Area A		1.68		0.74		0.12	2.54
Area B	0.13	1.47		0.51		3.65	5.76
Area C		0.34		0.51		0.06	0.91
Area D		0.28		0.29		0.11	0.68
Other	0.05	1.04		0.91		0.53	2.53
Total	16.92	16.09	24.98	10.11	16.47	15.43	100.00

*Area A includes Maine, Vermont, New Hampshire, Massachusetts, Rhode Island, and Connecticut; Area B includes New York and Pennsylvania; Area C includes Virginia; and Area D includes Georgia, South Carolina, and North Carolina.

Source: Ohio Grain Market Survey, 1976.

the 3-unit train facilities in Toledo. Truck shipments to Dayton and Decatur increase in the same time period, but this may be primarily due to the filling of storage units in this off-harvest period. Toledo, Fostoria, Lima, and Troy receive most of their shipments in the fall harvest period. And as can be seen in Table 7, Dayton receives grain from CRD 4 in rather even amounts throughout the year.

Other domestic interstate destinations include Areas A, B, C, and D. More than 12% of the grains marketed from CRD 4 moved by rail to these regions. Area B received more than twice as much grain as any other domestic destination. The majority of shipments to Area B were made in the off-harvest period. This may occur because local supplies become depleted and feed mills build up grain stocks before expected price increases in the summer months.

Export points in Baltimore, Norfolk, and Philadelphia received nearly 18% of the grain marketed from CRD 4. Norfolk received slightly more than Baltimore (Table 7). All of these shipments moved by rail and a majority of them occurred in the off-harvest season.

Grain Flows—Crop Reporting District 5

Grain flows from CRD 5 show an even more dramatic decline in the use of trucks to transport grain from the area. Only 23% of the shipments occur by truck. The majority of these are to such transshipment points as Columbus, Marion, and Cincinnati. More than 40% of the grain moved to export points on the East Coast (Table 8). A dramatic change since 1970 is that Toledo is less important while Marion, Columbus, and Cincinnati have become major competitors for intrastate grain flows from this region.

Marion received 9% of the grain marketed in CRD 5, probably due to the major soybean processor and transshipment point in this location (Table 8). Columbus received more than 5% of the marketable grain, most of which is transshipped to export. Cincinnati gets more than 4% of the grain, which demonstrates the influence of barge shipments upon the area.

TABLE 8.—Seasonal Percentages of Total Grain Flows by Truck and Rail from Crop Reporting District 5, Crop Year 1975-76.

Destination	Summer 1975		Autumn 1975		Spring 1976		Total
	Truck	Rail	Truck	Rail	Truck	Rail	
	percent						
Ohio Region							
Ashland, Ky.	0.16		0.12		0.05		0.33
Bellevue	0.57		0.18	0.09	0.33	0.01	1.18
Cincinnati	1.23	0.10	0.55		2.58		4.46
Circleville	0.23	0.01	0.25	0.04	0.51		1.04
Columbus	1.44	0.79	1.59	0.28	0.89	0.57	5.56
Delphos	0.01		0.07		0.30		0.38
Dayton	0.22	0.01	0.22		0.08		0.53
Fostoria	0.13	0.71	0.03	0.41		0.15	1.43
Hillsdale, Mich.		0.20		0.01		0.03	0.24
Lima				0.05			0.05
Logan	0.13		0.04		0.06		0.23
Loudonville		0.36					0.36
Marion	1.53		3.00	0.44	4.03		9.00
Toledo	0.01	0.64	0.14	0.03	0.04	0.01	0.87
Troy					0.06		0.06
Export Markets							
Baltimore		12.58		10.37		12.84	35.79
Norfolk		1.27		3.38		2.23	6.88
Philadelphia				0.12		1.55	1.67
Other U. S. Markets*							
Area A		0.49		0.45		0.10	1.04
Area B		2.76		1.84		0.28	4.88
Area C		2.80		3.33		6.43	12.56
Area D	1.03	1.71	0.99	2.41		2.15	8.29
Other		1.78		0.73	0.23	0.43	3.17
Total	6.69	26.21	7.18	23.98	9.16	26.78	100.00

*Area A includes Maine, Vermont, New Hampshire, Massachusetts, Rhode Island, and Connecticut; Area B includes New York and Pennsylvania; Area C includes Virginia; and Area D includes Georgia, South Carolina, and North Carolina.

Source: Ohio Grain Market Survey, 1976.

The flow of grain to Cincinnati increases dramatically during the winter and spring when the lake is frozen. The Cincinnati demand is more stable throughout the crop year than that of the Toledo area. Shipments to Columbus are fairly evenly distributed throughout the three time periods. But Marion received the vast majority of its grain during the fall and off-harvest periods. Much of this off-harvest demand is due to the relatively constant demand of a local processor.

Domestic interstate destinations received nearly 27% of the marketable grain (Table 8). Areas C and D received the vast majority of these shipments. Area D also received a significant amount of grain by trucks, due mainly to backhauls by southern truckers. Area C continues to exert a strong influence, demanding more than 12.5% of the area's grain. More than half of these shipments occur in the off-harvest period. The other domestic demands for grain are fairly constant over the three time periods.

CRD 5 ships more than 42% of its marketable surplus to Baltimore and Norfolk. Shipments to Baltimore, nearly 36%, are fairly constant throughout the time periods (Table 8). Movements to Norfolk are least in the summer and highest in the fall. The majority of these shipments originate from Columbus and Marion.

Grain Flows—Crop Reporting District 7

This area has the least number of destinations for its marketable grains. These destinations are few in number but large in demand (Table 9). Cincinnati has a strong demand for grain, receiving more than 60% of the area's shipments. Cincinnati, Columbus, and Dayton receive 87% of the region's marketable grain. This small number of markets is due in part to the problem of rail shipments to the South discussed earlier. A solution to these problems would increase the number of markets for grain from this region.

Flows to Cincinnati are nearly even during the summer and fall periods. But demands increase substantially during the off-harvest period when the lake is not navigable (Table 9). Dayton draws nearly 18% of the marketable grains. The larger shipments occur during the fall and spring. Columbus, on the other hand, receives most of its grain from CRD 7 during the summer period.

Domestic interstate destinations received little grain from the areas. The vast majority of grain was shipped to Area D. All of these movements occurred via rail services (Table 9).

Export points on the East Coast showed no grain receipts from CRD 7. However, Cincinnati is now a major transshipment point to the Gulf exporters. The importance of Cincinnati in this respect is shown by its unusually strong influence on grain flows in the region.

CONCLUSIONS

The Ohio grain production and marketing systems have changed considerably in recent years. The Ohio railroad system has been reorganized under the Rail Revitalization and Regulatory Reform Act of 1976. A government owned-for-profit corporation, Conrail, has been created to assume control of the Penn Central and other bankrupt carriers in the Northeast and Midwest regions of the U. S.

Due to increased grain production, the physical volume of grain to be transported is substantially larger than it was a few years ago. Total market-

TABLE 9.—Seasonal Percentages of Total Grain Flows by Truck and Rail from Crop Reporting District 7, Crop Year 1975-76.

Destination	Summer 1975		Autumn 1975		Spring 1976		Total
	Truck	Rail	Truck	Rail	Truck	Rail	
	percent						
Ohio Region							
Cincinnati	17.08		17.95		25.30		60.00
Columbus	5.88	1.65	2.53		0.45		10.51
Dayton	3.62		7.56		6.75		17.93
Fostoria		0.37		0.36			0.73
Marion	0.30		1.21				1.51
Toledo		1.07	0.30	0.36		0.56	2.29
Other U. S. Markets*							
Area C						0.44	0.44
Area D		0.98		1.84		3.44	6.26
Total	26.88	4.07	29.55	2.56	32.50	4.44	100.00

*Area C includes Virginia and Area D includes Georgia, South Carolina, and North Carolina.
Source: Ohio Grain Market Survey, 1976.

able surplus of grain in the study area was estimated to be 221.3 million bushels in 1975.

Market structure in the Ohio grain industry has also changed dramatically. The number of elevators has decreased from 1,224 in 1954 to 926 in 1975—a 25% decline. The decrease in elevator numbers has been least rapid in the western part of the state. The total storage capacity of the elevator sector and the storage capacity per elevator have increased rapidly. The average storage capacity per elevator was more than 216,000 bushels in 1975. The number of elevators has decreased most rapidly among those firms with less than 100,000 bushel storage capacity. The number of large elevators with more than 900,000 bushel storage capacity has increased very rapidly.

Grain flows have changed dramatically. More than 40% of the study area grain is shipped to export markets on the East Coast, Gulf Coast, and to domestic destinations in the Northeast and Southeast. Export markets have become more important and other domestic markets less important for Ohio grain than in the 1960's.

More than 50 destinations for Ohio grain were identified by firms in the study area. The major intrastate markets are Bellevue, Columbus, Cincinnati, Dayton, Delphos, Fostoria, Lima, Marion, Sidney, and Toledo. Major interstate destinations include the Northeast, the Southeast, and the export markets of Baltimore, Norfolk, and Philadelphia.

Ohio has 27 elevators with the capability to load 60 or 100-car unit trains. None of these facilities loaded unit trains in 1971. Many of these elevators are large sub-terminal facilities located in the grain producing area. These elevators buy directly from producers and sell to exporters. Previously only terminal elevators in urban areas had direct access to this market. This transportation innovation has greatly influenced the destination and flow of grain in the study area.

Rail transport is still the most important mode of transport for the study area's grain. About 64% of all grain was shipped by rail and 36% by truck. The intrastate destinations are served almost entirely by truck. The interstate shipments are made almost entirely by rail. Unit train and multi-car rail account for nearly all the interstate grain shipments.

Seasonally, grain shipments tend to be very concentrated in the harvest period. More than 85% of the wheat moved to market from June 1 to August 31, 1975. Half of the corn and about 30% of the soybeans moved to market in the harvest period of Sept. 1 to Dec. 31, 1975. Hence, the marketing and transportation system must effectively handle large volumes of grain in these time periods.

The grain flows of the 1975-76 crop year should be quite representative of Ohio grain flows for the next several years. The state had neither a record grain crop nor an extremely small one. The weather was near normal. Many of the market adjustments of the early 1970's have been completed and are reflected in the grain flows of the mid 1970's. Thus, the grain flow pattern described in this research should be a good indicator of grain flows during the next few years barring any major change in world market conditions, U. S. domestic farm policy, or a natural catastrophe.

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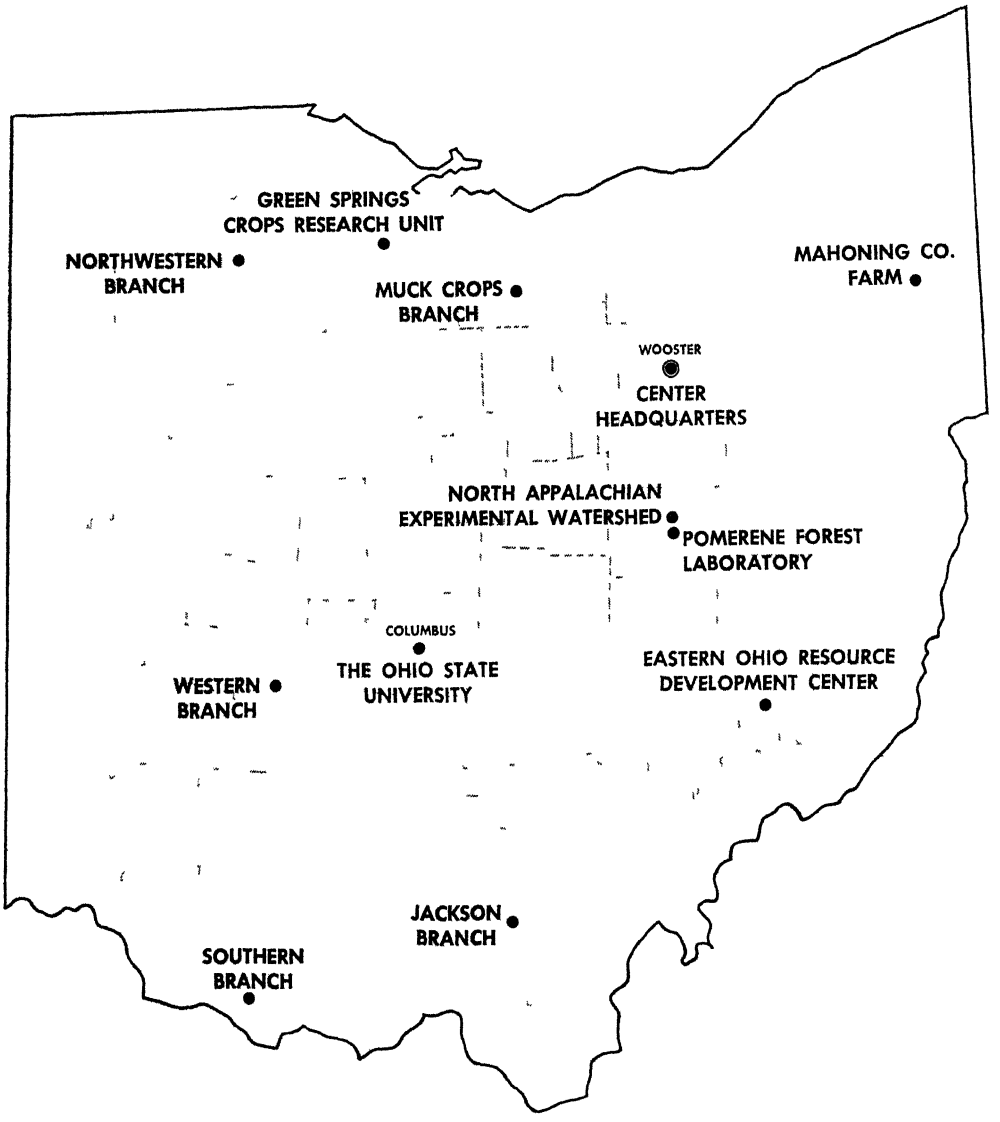

Ohio's major soil types and climatic conditions are represented at the Research Center's 12 locations.

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Northwestern Branch, Hoytville, Wood County: 247 acres

Pomerene Forest Laboratory, Coshocton County: 227 acres

Southern Branch, Ripley, Brown County: 275 acres

Western Branch, South Charleston, Clark County: 428 acres